Soil Management Plan
Old Town Demolition Project
Phase One

Prepared by:
Environment, Health and Safety Division
Lawrence Berkeley National Laboratory

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Ernest Orlando Lawrence Berkeley National Laboratory
Berkeley, CA 94720

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Plan Approval

PREPARED:

David Baskin, LBNL Environmental Services Group — date 7/24/14

REVIEWED:

Steve Enright, LBNL EHS Old Town Demolition Coordinator — date 7-24-14

Rob Connelly, LBNL Industrial Hygiene Group — date 7.25.14

Keith Heinzelman, LBNL Radiation Protection Group — date 7/24/14

Maram Kassis, LBNL Waste Management Group — date 7/24/14

APPROVED:

Joe Gantos, LBNL EHS Old Town Assurance Manager — date 7/24/2014

David Kestell, LBNL Department Head — date 07/28/14
Environment, Waste & Radiation Protection Department

Robert Cronin, LBNL Senior Project Manager — date 7/28/14

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1. Purpose: The purpose of this Soil Management Plan (SMP) is to define the procedures for soil management associated with the Old Town Demolition Project (Project), at Lawrence Berkeley National Laboratory (LBNL). The objective is to properly manage soils resulting in no adverse impact to human health or the environment and that soils are handled, used, and stored in accordance with applicable laws, regulations, and LBNL policies.

Packaging and disposal of waste soil are controlled by the *Waste Management Plan for Phase One of Old Town Demolition* (WMP). Soil handling, daily covering, dust control, runoff management etc., are managed in accordance with the approved *Stormwater Pollution Prevention Plan* (SWPPP).

2. Scope: The scope of this SMP covers soil handling associated with demolition activities conducted during Phase One Old Town Buildings 5, 16, 16A, 40, 41, 52, 52A and, the electrical pad located directly north of and contiguous with B16A. Figure 1 shows Phase One work areas. This SMP addresses soil management associated with the following activities:

- Demolishing and removing of structures, foundations, utilities, and pavement;
- Potholing for locating subsurface utilities;
- Cutting, capping, and removal of underground utilities;
- Relocating underground utilities;
- Backfilling utility excavations associated with deactivation;
- Sampling and analyses of soils for appropriate chemical or radioactive constituents to determine appropriate use, disposal, or maintenance in place;
- Characterizing subsurface contamination;
- Excavation of contaminated soil;
- Importing, stockpiling, and handling of clean materials, including engineered fill; and
- Stabilizing the site, including grading and constructing retaining walls.

3. Schedule: Phase One of this Project is tentatively scheduled for August 2014 through November 2015.

4. Roles and Responsibilities: Following are the general roles and responsibilities of the parties involved in soil management activities.

a. LBNL's Facilities Division – The Design and Construction Management Department is responsible for general oversight of demolition and soil management activities performed by the demolition subcontractor(s) and ensuring work is completed in accordance with requirements of this SMP. The LBNL Project Manager or designee (Project Manager) is the point of contact.

b. LBNL's demolition subcontractor(s) will perform the following activities under the direction of LBNL's Project Manager, in accordance with the SMP:

- Excavate contaminated soil to limits at or below levels presented in Attachment 2, Table 1 and Attachment 3 or as directed by the Project Manager;
- Identify, along with remove or relocate subsurface utilities;
- Maintain a safe and healthy work environment;
- If requested by the Project Manager, produce an acceptable site-specific Health and Safety Plan (HSP);
- Proper decontamination of equipment (backhoes, trucks, shovels, etc.), personal protective equipment (PPE), and sampling equipment, along with control and management of wastes;
- Control access to the work area;
- Prepare an approved Sampling and Analysis Plan (SAP), including quality assurance, for chemical and radiological testing of excavated and in place soil;
- Sample and analyze soil in areas identified during the Project as having potential contamination;
- Characterize soil in areas where contamination is excavated, to document acceptable residual levels remaining in place;
- Maintain accurate samplings, verification field screening, extent of excavations, and observed utilities locations, either by surveying x, y, and z coordinates or other appropriate method(s), as approved by the Project Manager. Provide accurate maps and supporting data;
- Sample and analyze soil providing data to document compliance with landfill waste acceptance criteria or acceptability for onsite reuse;
- Identify geotechnically suitable soils for reuse defined by appropriate soil type, other characteristics, lack of debris, and acceptable analytical results;
- Stockpile soil for onsite reuse at staging location(s) as directed by the Project Manager;
- Store or hold soils for hazardous/radioactive testing;
- Follow the approved SWPPP, including soil handling, labeling, chain of custody, daily covering, dust control, and runoff management. Care will be taken not to have any stormwater drain directly into excavation or work areas;
- Maintain quarantine controls over each soil storage location to ensure no mixing occurs while waiting for test results and a determination of disposition;
- Place and compact reused soil;
- Field screen, observe, and document soil for evidence of potential chemical or radioactive contamination;
- Notify LBNL and stop work if conditions indicate potential contamination, other criteria is meet (debris, utilities, etc.), or groundwater is initially observed;
- Dispose of waste soils in accordance with requirements specified in the WMP;
- Prepare a *Soil Management Report* documenting (with maps, tables, and text) the locations and volumes where soil was excavated, associated analytical test

results, chain-of-custody records, residual concentrations of chemicals in soil, relevant soil characteristics, field screening results, waste manifests, and final disposition (disposal, reuse, or storage) of all excavated soil, including documentation of onsite placement and grading;

- Maintain and provide all soil management and disposal records, including waste facility disposal applications and permits, to LBNL; and
- Import, place, and adequately compact LBNL approved clean soils, as directed by the Project Manager.

c. LBNL's Environment, Health and Safety Division (EH&S) Environmental Services Group (ESG) shall provide, as needed, the following supporting services:

- Modify or append this SMP, as necessary, to meet changed conditions or requirements;
- Review onsite excavations, identify in-situ soil sampling and field screening locations and tests, and management strategies;
- Aid in identifying sanitary sewers lines or other process lines that are historically or otherwise suspected of carrying chemicals;
- Aid in providing soil removal guidance to the subcontractor for radioactive contaminated soils;
- Disposal options and requirements; and
- Evaluate analytical results and other criteria for onsite soil reuse.

d. LBNL's Waste Management Group (WMG) is responsible for providing general oversight of Project waste management activities in accordance with the WMP.

e. LBNL's Radiation Protection Group (RPG) shall provide, as needed, the following supporting services:

- Provide guidance on sanitary sewers lines or process lines that are designated as radiological waste or suspect of radiological contamination;
- Assist in determining when radiological soil scanning/testing is required;
- Provide guidance in establishing controls for safely excavating, handling, and disposing of radionuclide-impacted LLW and MLLW soils and other impacted media;
- Assist with radiological controls and protocols to protect human health and the environment, while adhering to regulatory and LBNL requirements; and
- Assisting in evaluating radionuclide analytical results to assess reuse/disposal options and in achieving final site conditions per the *Multi-Agency Radiation Survey & Site Investigation Manual* (MARSSIM).

f. LBNL's Health and Safety Department (H&S) will assist in determining industrial safety, health, and hygiene requirements associated with activities specified under this Plan.

5. Activities that Generate Soils: Work activities that are anticipated to generate soils that need to be managed include:

- Demolition and removing of structures, foundations, utilities, and pavement;
- Removing process systems, building slabs, underground utilities, foundations, pavement;
- Potholing for locating utilities;
- Cutting, capping, and removal of underground utilities;
- Relocating underground utilities;
- Backfilling utility excavations associated with deactivation;
- Sampling and analyses of soils for appropriate chemical or radioactive constituents to determine appropriate use, disposal, or maintenance in place;
- Characterizing subsurface contamination;
- Excavation of contaminated soil;
- Importing, stockpiling, and handling of clean materials, including engineered fill; and
- Stabilizing the site, including grading and constructing retaining walls.

6. Soil Management: During activities covered by this SMP, the demolition subcontractor(s) must employ the following controls:

- Continuously observe and monitor excavation areas and in-situ soils as they are removed for signs of potential chemical, radioactive contamination, or debris. The LBNL Project Manager shall provide the necessary oversight to confirm these observations are taking place;
- Air monitoring with a photoionization detector (PID) or other monitoring equipment may be required by the H&S Department at excavation and work locations for workers safety. Air monitoring for field screening samples may also be employed. Monitoring with a mercury vapor analyzer is required where excavations are near sanitary sewer lines;
- PCB contaminated soils must be stored in accordance with the Toxic Substance Control Act (TSCA) regulations found in Subpart D of 40 CFR 761:
- Place soils (other than PCB contaminated soils) onto plastic sheeting (visqueen) or similar impermeable material or in plastic-lined bins or similar sealed containers. The stockpiled soil shall be completely covered at the end of each workday. The visqueen or similar material used to cover the soil must be weighed down or anchored to the ground and must completely cover the stockpiled soil to present wind-blown dust from being generated. Soil bins shall be closed when not in active use.
- Maintain discrete stockpiles and/or soil bins to facilitate sampling for reuse/disposal characterization. Subcontractor shall not mix soils from potentially radioactively contaminated areas with soils from other areas. The subcontractor shall not add, remove or mix soils in stockpiles/bins from different areas after they been sampled. The Subcontractor shall maintain records of the source location/area of each stockpile/bin.

- Subcontractor shall label each stockpile/bin with sufficient information in order to maintain a Chain of Custody control over each stockpile/bin. The responsible person's name, phone number, date of generation, location where the soil was generated, date of sampling, and sample identification are the minimum requirements of this label;
- Implementing dust control measures, such as covering soil stockpiles and wetting soil, as needed. Tacking agents may be required for LLW soils or potential LLW soils that are not stored in shipping packages. Any wetting of soil must be kept to a minimum to avoid runoff to drainage swales or discharge to drains. De-chlorination tablets must be used wherever there is a risk of potable water entering the storm drainage system; and
- Segregating debris from excavated soil. However washing of debris is not required.

7. Operational Requirements: The demolition subcontractor(s) must stop work in the general area and immediately contact the LBNL Project Manager if any of the following conditions are encountered**.**

- A positive reading above a threshold level on air monitoring equipment;
- Soil that smell of oil, gasoline, or solvents/chemicals;
- Soil that contain buried debris;
- Soil that appears discolored, stained or wet;
- A release identified from a subsurface utility;
- Soils that contain visible non-soil materials (sheens, powders, chemicals, non-aqueous liquids such as beads of mercury, or unknown solid wastes);
- Broken process piping/sanitary sewer lines or signs of leaking from process piping/sanitary sewer or drain lines into surrounding soil. This is particularly important around Building 5 due to the historical use of radioactive materials;
- When groundwater entering the excavation is initially observed; or
- Any asbestos-contain material (ACM) is identified.

After stopping work, the LBNL Project Manager will notify the LBNL Environmental Health & Safety (EH&S) Team Lead. The LBNL EH&S Team Lead then notifies the LBNL ESG, LBNL H&S and LBNL RPG (if radionuclides are a concern). LBNL H&S and RPG if necessary, will evaluate potential worker exposure to contaminates and, if warranted, implement additional engineering or administrative controls, including upgrading the Personal Protective Equipment (PPE) requirements. If radiation is known or suspected a Radiation Work Authorization (RWA) may be required, prior to resuming work. Work will not resume until approved by the EH&S Team Lead, with concurrence from H&S, ESG, and RPG if radionuclides are known or suspected.

8. Chemical and Radiological Testing of Soil: The demolition subcontractor(s) will prepare and submit a Sampling and Analysis Plan (SAP) to LBNL for review and approval. The SAP must cover the following activities related to radioactive and chemical sampling of excavated and in place soil, at a minimum:

- Sampling and analysis of soil to comply with onsite reuse acceptance criteria (see Attachment 2, Table 1 and Attachment 3 for determining its suitability for reuse

within the same area that the soil was generated, provided approval is obtained from LBNL;
- Sampling and analysis of soil to assess potential areas of contamination identified during the demolition process;
- Sampling and analysis of soil documenting levels of contamination remaining in-situ soils after excavation is completed;
- Sampling and analyzing product associated with a utility (e.g. sanitary sewer or process lines, sumps, etc.);
- Accurately locating and documenting sampling locations, notating any known/discovered subsurface utilities, and locations of suspected or known contamination; and
- Quality control and quality assurance (QA/QC).

Prior to developing the SAP, an outline may be required by the LBNL Project Manager. Guidance for preparing a SAP is provided in *Sampling and Analysis Plan Guidance and Template Version 4, General Projects R9QA/009.1* May 2014 (http://www.epa.gov/region9/qa/pdfs/sap-general.pdf). The SAP must be signed and stamped by a California-licensed Professional Geologist (PG) or other licensed professional approved by LBNL, and submitted to and approved by LBNL before any samples are collected.

At a minimum, the SAP must include the following:

- A description of the activities that require sampling and analysis;
- Identification of the chemical/radiological contaminants of potential concern (COPCs);
- design, including specification of the number, locations, and depths where samples will be collected;
- Sampling and analysis approach, including criteria, description of sampling equipment, and requirements for collecting, labeling, storing, chain-of-custody, and transporting samples to the laboratory;
- Sample analysis requirements, including specific reference to the state certified laboratories that will perform the analyses, the analytical methods to be used, holding time, and the required reporting limits;
- QA/QC samples and criteria; and
- An accurate base map.

Polychlorinated biphenyls (PCBs), petroleum hydrocarbons, volatile organic compounds (VOCs) have been detected in the soil in the Project area. In addition, elevated concentrations of metals have been detected. Analysis of samples for characterization and to determine disposal/reuse may include the following:

- VOCs by EPA Method 8260
- PCBs by EPA Method 8082
- TPH (diesel- and motor oil-ranges) by EPA Method 8015
- Metals by EPA Method 6000 and 7000 series

Samples from areas potentially impacted by radionuclides must be analyzed for the appropriate radionuclides of potential concern.

Additional or different sampling and analysis requirements may apply to waste soils being disposed offsite in order to meet the Waste Acceptance Criteria (WAC) of the receiving facility.

Sampling procedures for characterization of polychlorinated biphenyls (PCBs) shall comply with 40 CFR 761 Subpart N or equivalent.

Prior to finalizing the SAP, LBNL will provide a map to the demolition subcontractor showing the areas where specific chemicals/radionuclides of potential concern (COPCs) have been detected in the soil. Following demolition activities that remove soil, the demolition subcontractor is required to document residual levels of remaining in place (verification sampling). Verification sampling for PCBs shall comply with 40 CFR 761 Subpart O or equivalent.

Samples submitted for chemical testing must be analyzed by a California Department of Health Services (DHS) ELAP certified laboratory for the analyte or analytes of interest, that has been pre-approved by ESG or WMG.

Samples submitted for radioactive testing must be analyzed by a laboratory with successful DOECAP qualification and which has been pre-approved by RPG or WMG.

Particular attention must be paid around process piping and sanitary sewer lines for indications of radioactive contamination. Radiological soil scanning shall employ probes that are optimized for low energy photons and alpha and beta contamination as applicable.

9. Soil Profiling, Release, and Disposal: Requirements for offsite waste soil disposal are specified in the WMP and include the following:

- Waste profiling;
- Waste processing;
- Waste packaging;
- Shipment documentation;
- Transportation; and
- Records keeping (including Chain-of-Custody (COC) records and analytical results).

Soil testing (i.e. chemical/radioactive sampling and laboratory analyses) may not be required for soil that have no indication of contamination and that are replaced in the same location where they were excavated.

Soil that contains radionuclides at concentrations below the calculated RESRAD/DCGL levels provided in Attachment 2, Table 1 of this document and/or chemical constituents below the levels specified in Attachment 3 of this document may be reused within the same area that the soil was generated, provided approval is obtained from LBNL. Placement of reused soil may require compaction, at the discretion of the LBNL Project Manager. If not reused in the same area, this soil must be disposed of offsite in accordance with requirements in the WMP. Background levels of metals in LBNL soils are depicted in Attachment 1.

NOTE: the Attachment 2, Table 1 levels are based on only one radionuclide being present, if multiple radionuclides are present in the sample, "Sum of the Fractions" method applies.

Soils meeting the limits of Attachment 2, Table 2, (the Lc values) are deemed non-radioactive for the purposes of regulatory control.

All surplus soil (not needed for backfilling or other on-site reuse) shall be transported offsite for disposal in accordance with the WMP.

10. Soil Management Reporting: The demolition subcontractor will prepare and submit a *Soil Management Report* to LBNL for review and approval. The report must include the following information related to soil management, at a minimum:

- Locations, depths, and in-situ volumes where soil was excavated;
- Accurate locations and depths where samples were collected;
- The site configuration, excavation, underground utilities and disposition, and sampling locations and detected concentrations will be provide on an accurate map or maps;
- Surveying may be required to accurately locate (aerial and depth) excavations, samples, observations, field screening, and subsurface utilities;
- Copies of all laboratory analytical reports, with detection limits, and COC records;
- Tables with analytical results, including detection limits;
- Final disposition (e.g. specific disposal facility or onsite reuse location) of all excavated soil, referenced to the location where the corresponding soil was excavated;
- Sources of and test results for any imported backfill and locations where placed;
- Maps showing surveyed locations where verification samples were collected;
- Copies of all applicable soil profiling, waste acceptance applications and approvals, waste manifests, analytical results, and COC records, along with transport and disposal documentation;
- Photo-documentation (photograph and date) of soil management activities including potential release locations from underground utilities and observations;
- Other relevant information determined by LBNL or the contactor; and
- This document is to be signed by a California Professional Geologist.

Figure 1. Aerial View of Old Town Demolition Project.

Attachment 1

Upper Estimate of Background Metals Soil Concentrations for LBNL

Metal	Concentration (mg/kg)
Antimony	<6
Arsenic	24
Barium	410
Beryllium	1.0
Cadmium	5.6
Chromium	120
Cobalt	25
Copper	63
Lead	43
Mercury	0.42
Molybdenum	4.8
Nickel	272
Selenium	4.9
Silver	2.9
Thallium	10
Vanadium	90
Zinc	140

Source: Analysis of Background Distribution of Metals in the Soil at Lawrence Berkeley National Laboratory, Revised April 2009.

Attachment 2

Table 1: Limits for Residual Radionuclide Concentrations in Soil for the Old Town Project

Radionuclide	RESRAD (ICRP 60; 1 mrem per year)	Analysis Method RL
Cs-137	2.0 pCi/g	0.1 pCi/g
Eu-152	1.0 pCi/g	0.5 pCi/g
Eu-154	1.0 pCi/g	0.5 pCi/g
Eu-155	45.8 pCi/g	0.5 pCi/g
H-3	6,470 pCi/g	1 pCi/mL
Sr-90	137 pCi/g	3 pCi/g
Am-241	51.3 pCi/g	1 pCi/g
Cm-243/244	10.6 pCi/g	1 pCi/g
Pu-238	64.6 pCi/g	1 pCi/g
Pu-239/240	58.5 pCi/g	1 pCi/g
Pu-242	62.6 pCi/g	1 pCi/g
U-234	436 pCi/g	1 pCi/g
U-235	8.6 pCi/g	1 pCi/g
U-238	36.6 pCi/g	1 pCi/g

Source: EWRP 04, Limits for Residual Radionuclide Concentrations in Soil for the Old Town Project. Revision 1.

NOTE: Concentrations listed in this table are based on having only one radionuclide present. If multiple radionuclides are present in the MARSSIM Survey Unit, the "Sum of the Fractions" method must be used to establish the acceptable concentrations for that Survey Unit.

Table 2: Critical Levels for Gross Alpha and Gross Beta Radioactivity in Soil (pCi/g)

Radionuclide	L_c[1] (pCi/g)	Analytical Method	RL[2] (pCi/g)
Gross Alpha	12	E900-4925	2
Gross Beta	28	E900-4927	2

1) L_c – critical level; 2) RL – reporting level

Source: EWRP 05, *Release Limits for Gross Alpha and Gross Beta Radioactivity in Soil for the Old Town Project,* Revision 0.

Attachment 3
Limits for Residual Chemical Concentrations in Soil for the Old Town Project

Chemical	Concentration (mg/kg)
Volatile Organic Compounds	
Benzene	0.044
Carbon tetrachloride	0.11
Chloroform	0.72
Trichloroethene (TCE)	0.01
Cis-1,2-dichloroethene (cis-1,2-DCE)	0.05
1,1-Dichloroethene (1,1-DCE)	0.18
1,1-Dichloroethane (1,1-DCA)	0.20
1,2-Dichloroethane (1,2-DCA)	0.0045
Methylene chloride	0.077
Tetrachloroethene (PCE)	0.15
Toluene	2.90
Trans-1,2-Dichloroethene (trans 1,2-DCE)	0.45
1,1,1-Trichloroethane (1,1,1-TCA)	3.21
Vinyl chloride	0.085
Xylenes	2.30
Petroleum Hydrocarbons	
Diesel	570
Oil	28,000
PCBs	
PCBs (total Aroclors)	1
Metals	
Antimony	470
Arsenic	24
Barium	220,000
Beryllium	200
Cadmium	5.1
Chromium (Hexavalent)	6.5
Chromium (Total)	1,800,000
Cobalt	350
Copper	47,000
Lead	320
Mercury	40
Molybdenum	5,800
Nickel	22,000
Selenium	5,800
Silver	5,800
Thallium	12
Vanadium	5,800
Zinc	350,000

Sources and Method of Calculation: Refer to Workplan for Preliminary Subsurface Investigation

Attachment 4
Potential Pollutants and Indicator Constituents
Old Town

Pollutant Source	Pollutant	Indicator Constituent
General		
Cleaning Products	Bleaches	Residual Chlorine
Painting Products	Paint Strippers	VOCs
	Sealants	COD
	Solvents	COD
	Thinners	COD
	Adhesives	Phenols
	Lead	Metal (Pb)
PCBs	PCBs	PCBs
Building 25A, B40, B41, B44, B44A, B44B Demolition		
Halogenated VOCs in groundwater	PCE, TCE, 1,1-DCE, cis-1,2-DCE	VOCs
Metal from Plating shop	Beryllium	Metal (Be)
	Chromium	Metal (Cr Total)
	Hexavalent Chromium	Metal (Cr+6)
	Cobalt	Metal (Co)
	Copper	Metal (Cu)
	Mercury	Metal (Hg)
	Silver	Metal (Ag)
	Vanadium	Metal (V)
	Zinc	Metal (Zn)
Building 52/52A Demolition		
Halogenated VOCs in groundwater	PCE, TCE, 1,1-DCE, cis-1,2-DCE	VOCs
Radioactive Materials	Low levels of induced radioactivity	Alpha and Beta
Total Petroleum Hydrocarbons in surrounding soils	Total petroleum hydrocarbons (TPH)	TPH (diesel and motor oil ranges)
Metal from Plating shop	Beryllium	Metal (Be)
	Chromium	Metal (Cr Total)
	Hexavalent Chromium	Metal (Cr+6)
	Cobalt	Metal (Co)
	Copper	Metal (Cu)
	Mercury	Metal (Hg)
	Silver	Metal (Ag)
	Vanadium	Metal (V)
	Zinc	Metal (Zn)

Attachment 4, cont.

Pollutant Source	Pollutant	Indicator Constituent
Building 5, B16,B16A, and the B16 Electrical Pad Demolition		
Halogenated VOCs in groundwater	PCE, TCE, 1,1-DCE, cis-1,2-DCE	VOCs
Polycyclic aromatic hydrocarbons (PAHs)	PAH	PAHs
Total Petroleum Hydrocarbons in surrounding soils	Total petroleum hydrocarbons (TPH)	TPH (diesel and motor oil ranges)
Metals from machine shop	Beryllium Chromium Hexavalent Chromium Cobalt Copper Mercury Silver Vanadium Zinc	Metal (Be) Metal (Cr Total) Metal (Cr+6) Metal (Co) Metal (Cu) Metal (Hg) Metal (Ag) Metal (V) Metal (Zn)
PCBs from oil filled transformers	PCBs	PCBs
Radioactive Materials	Europium-152/154 Americium-241 Cesium-137 Plutonium-239/240 Uranium-238	Europium-152/154 Americium-241 Cesium-137 Plutonium-239/240 Uranium-238

Source: Stormwater Pollution Prevention Plan, Old Town Demolition Project, Lawrence Berkeley National Laboratory. Revision 3, June 2014.